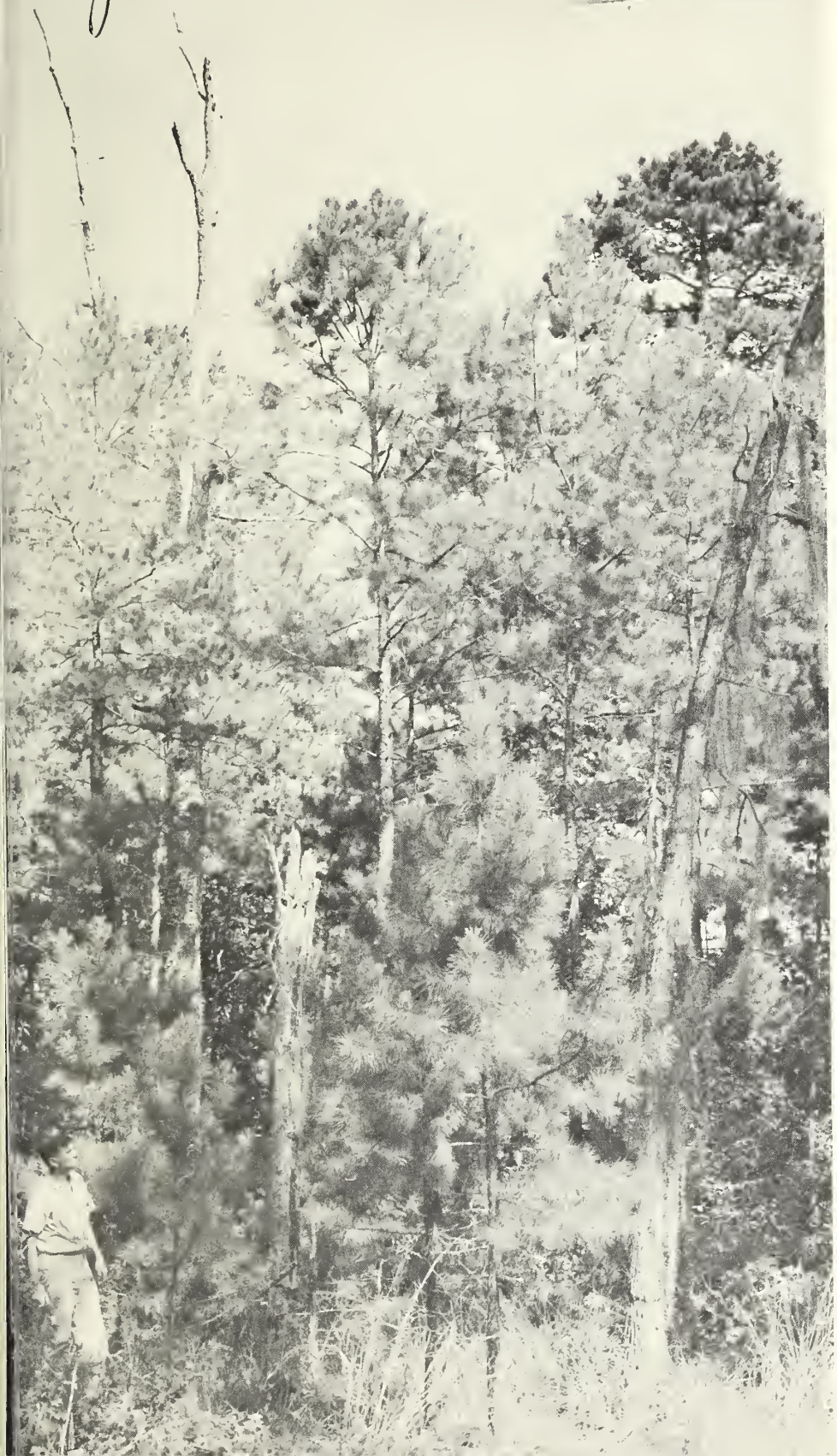
OCCASIONAL PAPER 175

1959



SELECTIVE CONTROL of CULL HARDWOODS in EAST TEXAS

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The four southern pines, shortleaf, longleaf, loblolly, and slash, make up the primary forest crop of east Texas and adjoining parts of Louisiana, Arkansas, and Oklahoma. They grow well on a wide range of soils, reach merchantable sizes early, and bring high average prices. Except on bottom lands and some other sites where hardwoods are best adapted, pine is the foresters' choice for timber production.

That choice must be followed up by positive action if pine is to be maintained on most upland sites in this area. Hardwoods, tolerant of shade and able to sprout from roots or rootcollars when above-ground parts are killed, develop under pine stands and take over promptly when the pines are harvested. Though sometimes useful for game food, they have little commercial value, and produce only inferior trees on dry upland sites. Throughout the pine forests of the West Gulf region, therefore, some degree of hardwood control is essential to profitable management of the pine species.

Approaches to hardwood control have included broadcast methods, such as prescribed burning and aerial spraying, and the treatment of individual trees. Each approach has advantages and limitations, each is particularly suited to some circumstances, and sometimes both may be needed.

Broadcast methods produce relatively uniform results over the area treated. They are selective only to the extent that the treatment or material affects certain classes of stems more than others. Thus prescribed fire is chiefly effective on small stems, and shows little species selectivity, while aerial spraying with silvicides takes out the large overstory trees, and may be quite selective as to species. With broadcast methods, there is little opportunity to save individual trees that may have potential value for wildlife food or timber.

Individual-tree treatments can be as selective as the skill of the operator or the intensity of supervision permits. Thus they permit economies by limiting treatment to undesirable trees actually affecting desirable stems, and they afford opportunity for considering each tree on its merits as a competitor for growing space and as a potential producer of timber or wildlife forage. During the past ten years, the Nacogdoches Research Center of the Southern Forest Experiment Station has devoted considerable time to development of selective methods.

[1] Nacogdoches Research Center, maintained in cooperation with Stephen F. Austin State College, Nacogdoches, Texas.

The earliest study in this field, installed in 1947, is still in progress. It was designed to compare the effects on pine growth from four intensities of hardwood control. Ax girdling or cutting was used except for one treatment in which sprouting was minimized by application of Ammate in groundline notches on trees under 8 inches in diameter. After 8 growing seasons, the treatments had had little effect on growth of pine trees above 10 inches in diameter at breast height, but had resulted in sizable, though not quite significant, increases in volume of trees from 5 to 9 inches d.b.h., and in numbers of trees in the 2-, 3-, and 4-inch diameter classes. The treatments which removed the most overtopping hardwoods were the most effective. The Ammate treatment prevented resprouting and was especially notable for increasing the numbers of pine stems in the 2- to 4-inch classes. In a few more years, when these small trees develop appreciable volumes, there will be demonstrable benefits from some or all of the test treatments.

Figure 1.--*Although stunted and suppressed before they were released by the girdling of overstory oaks in 1947, these pines were reaching merchantable size by 1959.*

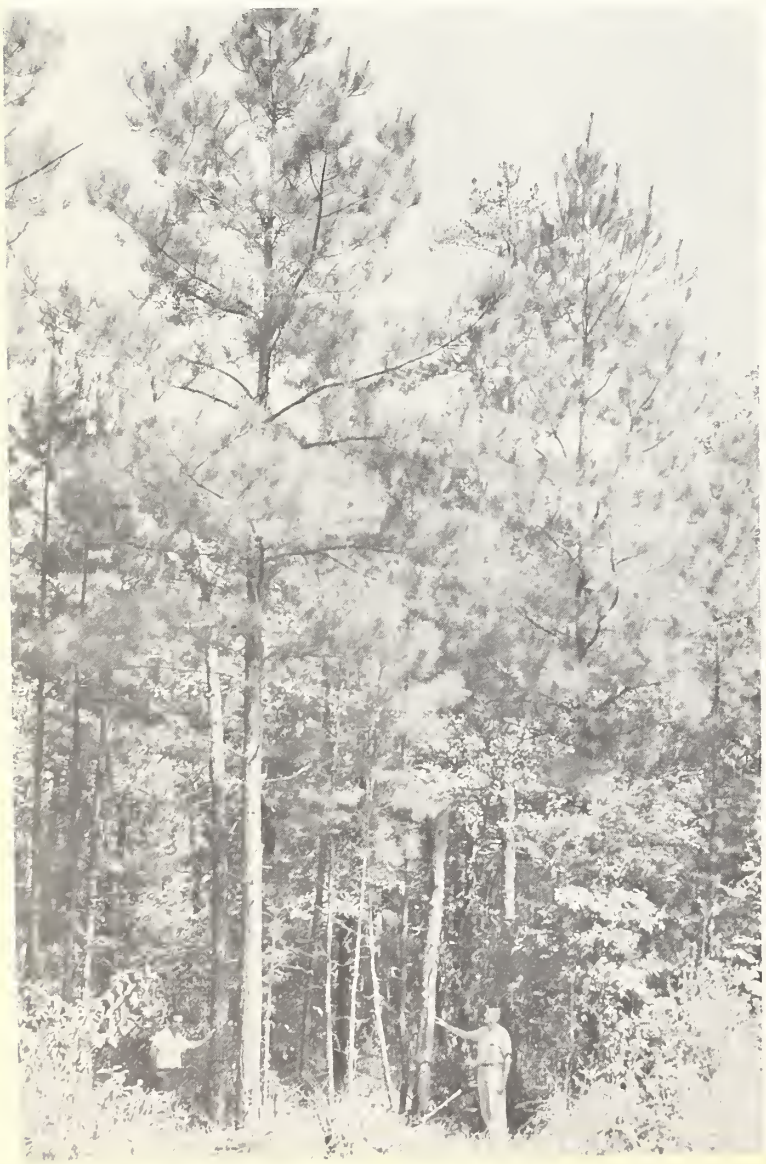


Figure 2.--*On areas not released in 1947, the few understory pines that remained in 1959 were contributing nothing to merchantable growth.*

Another finding of this study emphasized one of the hard facts of forestry at the western limit of the pine belt. None of the treatments resulted in establishment of new pine reproduction. Poor seed crops, trashy seedbeds, and summer droughts delayed seeding or killed each new crop of seedlings until released areas were reoccupied by brush. In Texas, where competition for soil moisture is intense, pine stems on the ground are precious assets, very much worth saving. So the Nacogdoches Center began to concentrate on methods that might help salvage a maximum of the fortuitous advance reproduction still alive in our upland stands.

POWER GIRDLING

A newly marketed power girdler was tested in 1954.[2] This machine, consisting of a rotary cutting head powered through a flexible shaft by a light gasoline engine carried on the operator's back, offered possibilities of reducing the manpower requirements and the accident hazards of ax work. It was found (fig. 4) that under east Texas conditions a man could treat about three times as many trees with the power girdler as with the ax. For example, to girdle 600 diameter inches per acre with the machine required 66 minutes, while the same amount of ax girdling took 3.5 hours. The advantages of the girdler were widely recognized and its use gave a considerable impetus to hardwood control in Texas and throughout the South.

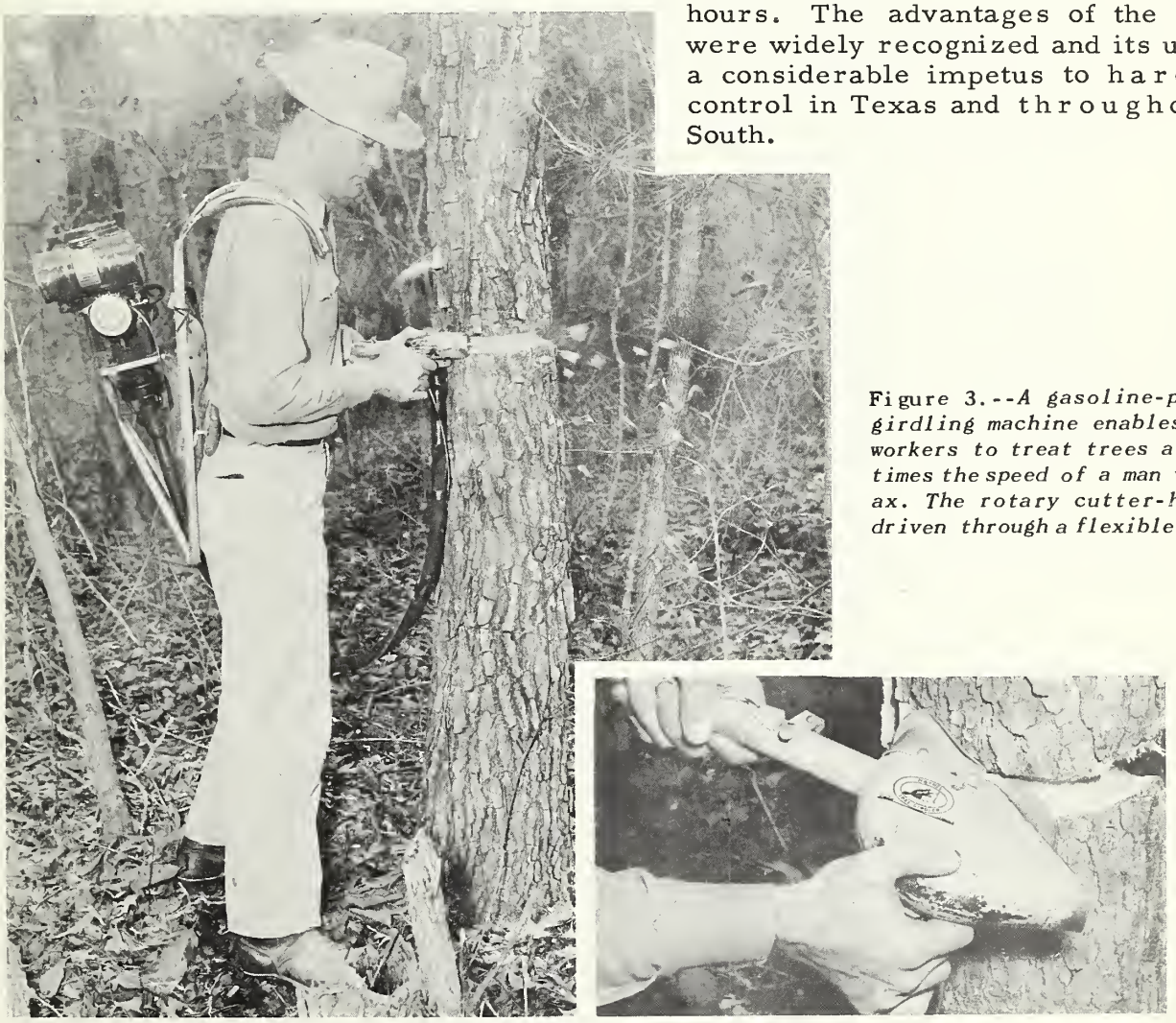


Figure 3.--*A gasoline-powered girdling machine enables woods workers to treat trees at three times the speed of a man with an ax. The rotary cutter-head is driven through a flexible shaft.*

[2] Harrington, T.A. 1955. More power to girdling. Forest Farmer 14(8): 12, 16-17, illus.

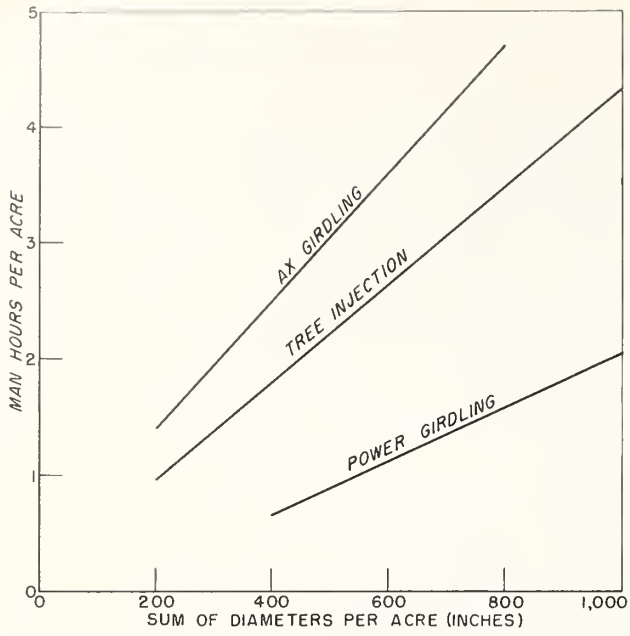


Figure 4.--*Labor required for girdling and injecting undesirable hardwoods in east Texas.*

Since the girdle made by the machine was shallow, trees died more slowly than after ax work, and on occasional stems, callus growth bridged the girdles, permitting the tree to survive. A survey[3] in 1955, covering some 6,000 trees treated by various methods, showed that bridging had occurred on 2.8 percent of the power-girdled trees, with an additional 4.9 percent showing callus growth short of bridging. This survey, 4 to 30 months after treatment, also showed (fig. 5) crowns killed on 35 percent of the power-girdled trees, as compared to 68 percent of those girdled with a double ax cut, and 44 percent of those receiving single ax frills. Only 11 percent of the power-girdled crowns were apparently unaffected, however, and eventual crown-kill of these trees is expected to approach 90 percent. This difference in promptness of kill was also revealed in a designed test on post oak and sweetgum, where two seasons after treatment top-kill was 90 percent for ax-girdled trees, and highly significantly greater than the 75 percent top-kill on power-girdled stems.

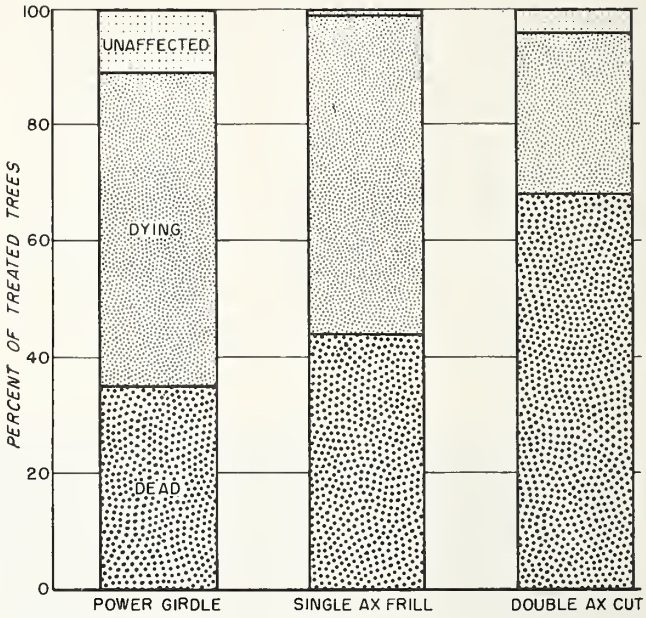


Figure 5.--*Condition of hardwood crowns, 4 to 30 months after trunks were girdled or frilled.*

SILVICIDES AS SPROUT SUPPRESSORS

While a good deal of temporary benefit accrues from killing undesirable crowns, adequate release of smaller pines requires that sprouting also be suppressed. The phenoxy silvicides looked promising, but experience in the Northeast,[4] where pines died when planted in spots freed of competition by 2, 4-D sprays, suggested that they might be too toxic to use near pines. In December 1953, the Nacogdoches Center installed a test using 2, 4, 5-T (propylene glycol butyl ether ester) at a concentration of 23.5 pounds ahg[5] in diesel oil as a basal spray and as a sprout suppressor on cut stumps.

[3] Mignery, A.L. 1956. What gives with girdling? Southern Lumberman 193(2417): 214-215, illus.

[4] Reigner, I.C. 1953. Do not plant trees too soon after using weed killers. U.S. Forest Serv. Northeast. Forest Expt. Sta. Res. Notes 20, pp. 3-4.

[5] Ahg is used in this report as an abbreviation for "acid equivalent per hundred gallons."

Loblolly pines planted within 24 hours after silvicide applications suffered no ill effects, and their survival was as good as those planted two months later.[6] Obviously the pines were sufficiently tolerant of 2,4,5-T to make this chemical a good candidate for use in selective hardwood removal. With this assurance, which has been confirmed by subsequent observations, work was concentrated on various selective applications of 2,4,5-T.

This chemical was tested as a supplement to girdling, in the hope that it would give quicker and more complete top-kill as well as sprout control. Because transportation of large quantities of liquid in the woods is laborious and expensive, applications of the concentrated propylene glycol butyl ether ester were tried, as well as the recommended 1-to-50 dilution in diesel oil. The concentrate (4 pounds acid equivalent per gallon) was applied as a fine spray from a squeeze bottle; the dilute solution was brushed on, in each case the equivalent of approximately 1 cc of concentrate per tree. These chemicals were applied in April 1955 to ax and power girdles on sweetgums and post oaks in three test areas--a total of 240 trees. In a companion test, sweetgums were machine-girdled and given the chemical treatments in January, July, and November.

Both concentrations accelerated top-kill (fig. 6), increasing from 85 to 99 the percentage of treated trees dead above the girdle after two years;[7] the difference is statistically significant. Only the dilute treatment, however, effectively reduced sprouting. For the April applications, the average percent of trees dead without sprouts was 42 without chemical and 56 with the concentrate, but the differences were not statistically significant. The dilute 2,4,5-T increased the non-sprouting mortality to 87 percent, a highly significant increase. With both chemical treatments, power and ax girdles resulted in practically identical percents of trees killed and not sprouting. The seasonal test produced high percentages of top-kill from girdles with either chemical at all seasons, but sprouting was much less frequent after growing-season treatment.

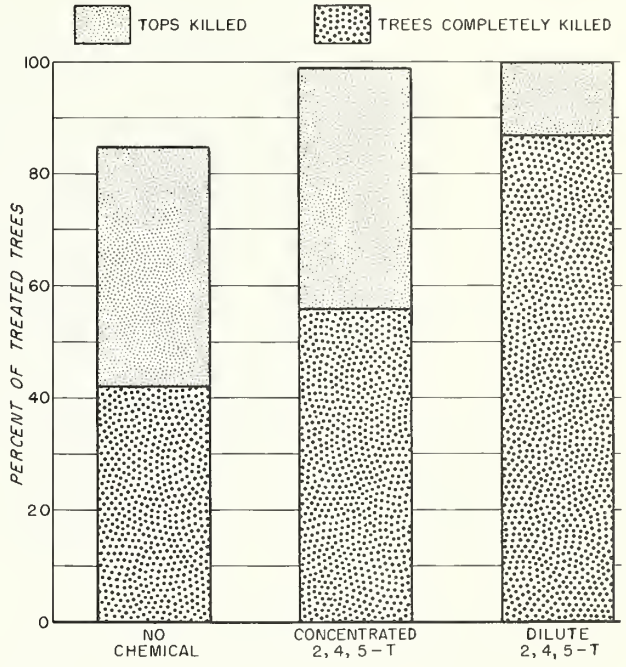


Figure 6.--*Effect of 2,4,5-T, at two concentrations, on sweetgum and post oak in east Texas.*

Two other studies have emphasized this seasonal variation in the effectiveness of 2,4,5-T as a sprout suppressor. In one,[8] where spring applications of dilute 2,4,5-T suppressed sprouts from post oak and sweetgum stumps more effectively than the same amount of chemical in concentrate form, winter treatments were ineffective. In the other,[9] December applications of a 23.5-pound ahg solution in diesel oil on

[6] Harrington, T.A. 1955. 2,4,5-T basal spray on hardwoods does not harm loblolly planted next day. U.S. Forest Serv. South. Forest Expt. Sta. South. Forestry Notes 95.

[7] Stransky, J.J. 1959. Concentrated or diluted 2,4,5-T as a supplement to girdling? Jour. Forestry 57: 432-434, illus.

[8] Davis, J.R. 1958. Diluted 2,4,5-T more lethal than undiluted in east Texas. Jour. Forestry 56: 516.

[9] Davis, J.R. 1958. Basal spray with 2,4,5-T for winter hardwood control in east Texas. Jour. Forestry 56: 349.

fresh stumps of small hardwoods delayed sprouting, only 37 percent of treated stumps having sprouted the following April as compared with 92 percent of untreated stumps. By the following spring, however, 97 percent of the treated stumps had sprouts. This is in strong contrast to the effectiveness of the same solution applied as a basal spray on standing trees, 93 percent of which died, though many retained their leaves through the first season. Only 5 percent of these trees sprouted.

It was concluded that where control of sprouting is important, basal spraying is most effective for small trees, while either ax- or machine-girdling should be supplemented by dilute 2, 4, 5-T. Best results can be expected from treatment during the growing season. Spraying with 2, 4, 5-T concentrate, though it hastened top-kill, did not effectively suppress sprouts.

There is need for further testing to determine whether some intermediate concentration of 2,4,5-T can be effective without being too bulky for use with a power girdler.

BASAL SPRAYS

After the tests with oaks and gums, basal spray with 2, 4, 5-T was tried on hawthorn and ironwood, which are pests on some of the best sites. A propylene glycol butyl ether ester in a 23.5 ahg dilution with diesel oil was applied in December, both as a basal spray and painted on cut stumps. For comparison, a slushy paste of Ammate in water was put on other cut stumps (table 1). Top-kill from basal spray was 100 percent for ironwood and 91 percent for hawthorn, and after two years none of the trees had sprouted.[10] The 2,4,5-T treatment on stumps suppressed sprouts on ironwood (2 percent sprouted), but not on hawthorn (45 percent sprouted). The

Table 1.--*Effect of phytocides 23 months after application to ironwood and hawthorn*

Treatment	Proportion of treated trees dead and without sprouts	
	Ironwood	Hawthorn
	Percent	*Percent*
Basal spray with 2,4,5-T	100	91
2,4,5-T on stumps	98	54
Ammate on stumps	90	52
Untreated stumps	36	11

Ammate was also effective on ironwood (10 percent sprouted), but not on hawthron (48 percent sprouted). This test was not repeated seasonally, but it is likely that both chemicals would have been more effective on the cut stumps during the growing season.

Success with basal sprays, which must penetrate the bark to become effective, led to the suggestion that high volatile esters of 2, 4, 5-T might be superior to the low volatile forms. A test on 240 small sweetgum trees (less than 3.6 inches in diameter) compared a pentyl with a propylene glycol butyl ether ester at 10 and 20 pound ahg concentrations in diesel oil. After two years, the low-volatile ester had killed 97 percent of the stems sprayed with the heavier concentration and 87 percent of the more lightly treated trees. The pentyl ester had killed slightly less, but the differences were not significant. No stems sprouted.

Thus the high-volatile esters appear to have no advantages for basal-spray applications, while the dangers from drift are well known. The relatively high kill from the 10 pound ahg concentrations suggests, however, that

[10]Mignery, A.L. 1956. Basal spray controls ironwood and hawthorn. Texas Forest News 35(4): 10.

Figure 7.--*Spraying the basal 18 inches of the trunk with 2,4,5-T in diesel oil killed oaks, sweetgum, hawthorn, and ironwood. Sprouting was negligible.*

there may be further opportunity for economy in the use of rather dilute solutions. Lest there be a temptation to extend this surmise too far, it might be added that no kill whatever was secured when one of the men accidentally sprayed a group of trees with pure diesel oil.

INJECTION OF SILVICIDES

Another approach to economy in application of silvicide came with the development of improved versions of the old Cornell tool.[11] These tools deposit chemical inside the bark at the groundline. Essential parts are a pipe that contains the chemical and has a cutting blade at its end, plus a device for releasing appropriate amounts of liquid into the wounds made by the blade. The blade is jabbed into the tree just above the root collar. Wounds must be closely spaced, preferably overlapping, since there is little lateral translocation of chemical.

In an early Texas test with such an injecting tool, the silvicide was a propylene glycol butyl ether ester of 2, 4, 5-T in a 36-pound ahg concentration in diesel oil. An experienced laborer treated the small hardwoods on 22 acres of experimental plots--a total of 5, 609 stems, mostly oaks, ranging from 1 to 7 inches in diameter, and averaging 2.1 inches.

The job required 2.12 man-hours and 0.87 gallon of the chemical solution per acre. The solution cost $1.31 per gallon. Thus with labor at $1.00 per hour, the cost of treating 255 small hardwoods was $3.26 per acre--$2.12 for labor and $1.14 for chemical. The job required considerably less labor than would have been required to cut or girdle these trees, but considerably more than power girdling. Since the alternate methods would have required

[11] Cope, J.A., and Spaeth, J.N. 1931. The killing of trees with sodium arsenite. Jour. Forestry 29: 775-783, illus.

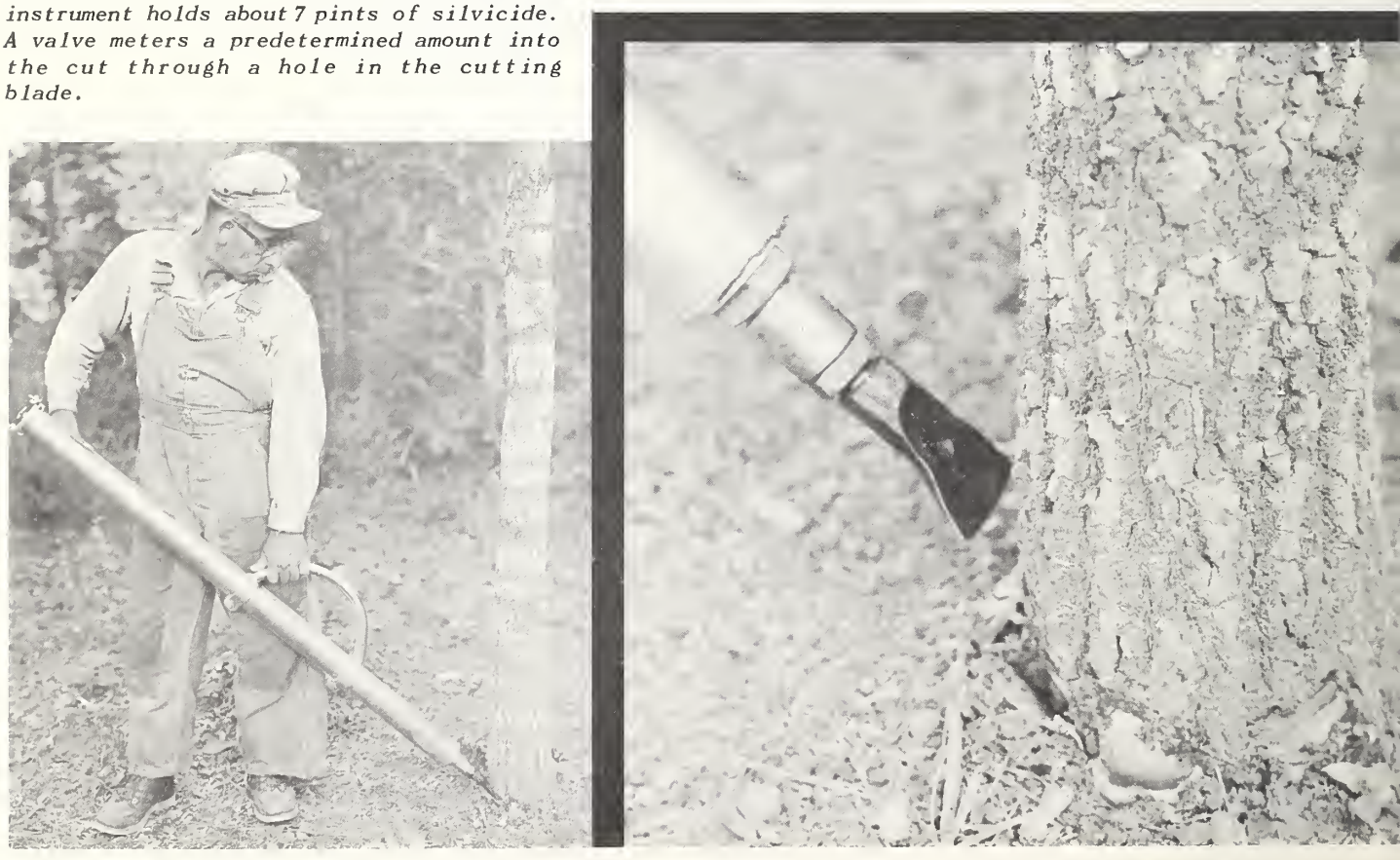
chemical follow-up to control sprouts, the injector treatment is competitive in cost where complete control is important.

When the test was reported in 1955,[12] the Nacogdoches Center was hopeful, but uncertain, about the ultimate effectiveness of tree injection. Subsequent observations on these plots and on many other areas indicate a high degree of effectiveness and almost complete absence of sprouting. Most of such failures as occur result from improper treatment--usually spacing injections too far apart. A few species, though, are consistently resistant to all but growing-season treatment.

The Texas National Forests cooperated in a study involving 480 sweetgum and oak trees, to test the effectiveness of iso-octyl ester of 2, 4, 5-T, which was available at 60 percent of the cost of the propylene glycol butyl ether ester. Four concentrations, 40, 20, 13.3, and 8 pound ahg in diesel oil, were applied as in a standard injector operation.

The 40-pound ahg concentration was 100 percent effective on both species; the 20-pound dosage killed 82 percent of the oaks but only 50 percent of the sweetgums (fig. 9). The lighter dosages were correspondingly less effective. Sprouting was negligible on top-killed trees of both species. The iso-octyl ester appears to be effective in concentrations comparable to those recommended for other low-volatile esters, and is being used extensively.

Figure 8.--*Injection of 2,4,5-T in cuts is an effective way to kill weed trees. The instrument holds about 7 pints of silvicide. A valve meters a predetermined amount into the cut through a hole in the cutting blade.*



[12] Davis, J.R., and Duke, W.B. 1955. Quick, Bunyan, the needle! South. Lumberman 191(2393): 171-172, illus.

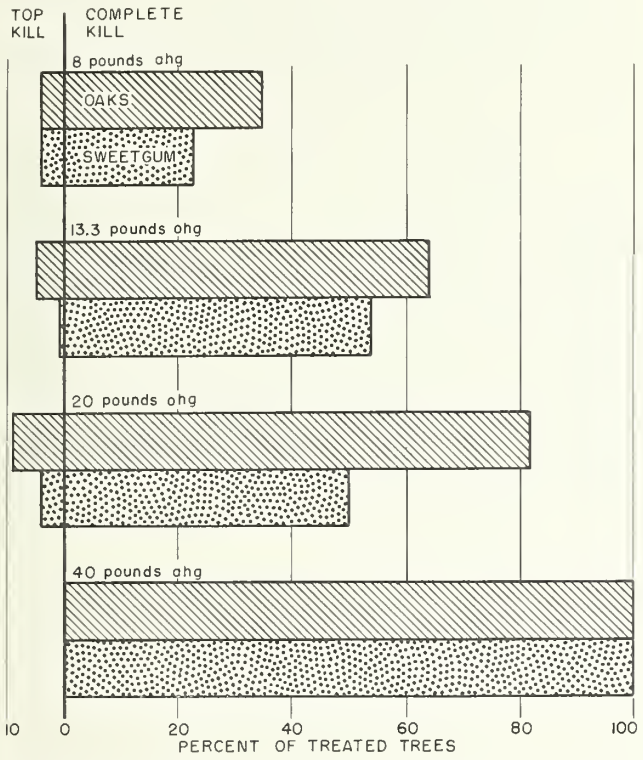


Figure 9.--*Effect of iso-octyl ester of 2,4,5-T, applied by tree injector.*

A test of 2,4-D amine was completed in 1958. The object was to determine if this material could be used full strength, thus greatly reducing the volume of fluid to be handled. Post oaks and sweetgums were wounded at the base with an empty tree injector, cuts being spaced approximately on three-inch centers as in normal treatment with this tool. Measured quantities of 2,4-D amine were then applied to each cut, half the trees receiving 0.5 ml. per cut, the remainder receiving 2.0 ml. (fig. 10).

After two growing seasons, the lighter dosage had top-killed 96 percent of the oak and 81 percent of the sweetgum, and the heavier dosage had top-killed 99 percent of the oak and 100 percent of the sweetgum. Sixteen percent of the gums sprouted, but there were no sprouts on the oaks. These results seem to confirm conclusions from other areas that amines of the phenoxy herbicides can be used in high concentrations, whereas the esters are not effective unless diluted. Further tests of the 2,4-D amine are desirable to determine an optimum dosage (perhaps about 1.0 ml.). A modified injector which can accurately meter these small quantities should be developed.

SUMMARY

Because reduced competition is essential to pine regeneration in east Texas, hardwood control is destined to play an increasingly important role in the forestry of the area. Where wide areas are to be reproduced, there will be need for the broadcast methods, including prescribed fire, aerial sprays, and machine clearing. For smaller areas, and the many stands with salvageable understories of desirable species, methods for deadening individual trees will find a place.

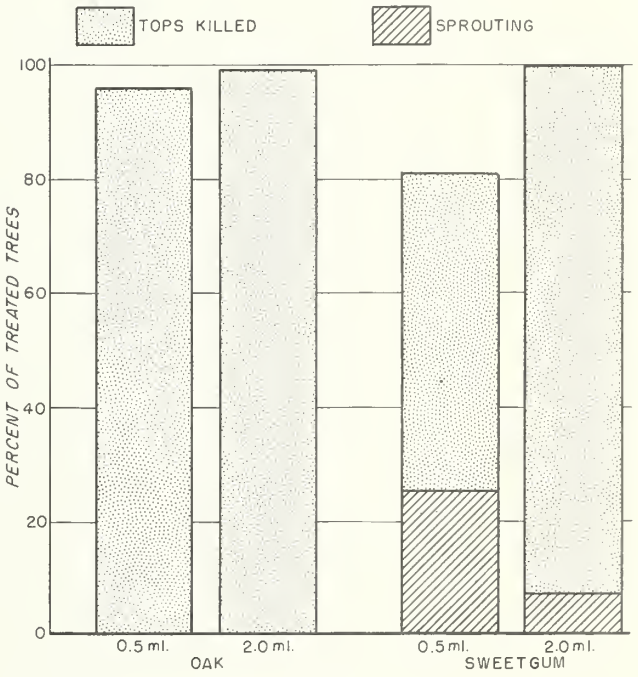


Figure 10.--*Effect of concentrated 2,4-D amine, applied by tree injector.*

Ax and machine girdling without chemicals are useful where sizable pines are to be released, but do not control sprouting. More and more, chemical methods that control both top and root are being recognized as essential for control of stand composition. Ammate is corrosive to metal and somewhat messy to handle, but nevertheless a good chemical--safe, effective, and reasonably cheap. The phenoxy silvicides offer possibilities of some economies and greater convenience. They can be effective as supplements to girdling, as basal sprays, and when injected beneath the bark. At present, tree injection seems to offer the best possibility for economical treatment of the troublesome small stems between 1 and 6 inches in diameter. It will be particularly efficient if the apparent possibilities of 2, 4-D amine can be fully exploited.

One further method, foliage spraying from the ground, is attracting interest in the South. The Nacogdoches Center has not tested it, but extensive trials in Arkansas and Louisiana indicate that it may be the most economic approach to control of small understory stems. If so, southern foresters will, for the first time, be equipped with procedures capable of dealing adequately with most of the hardwood problems of their region.